

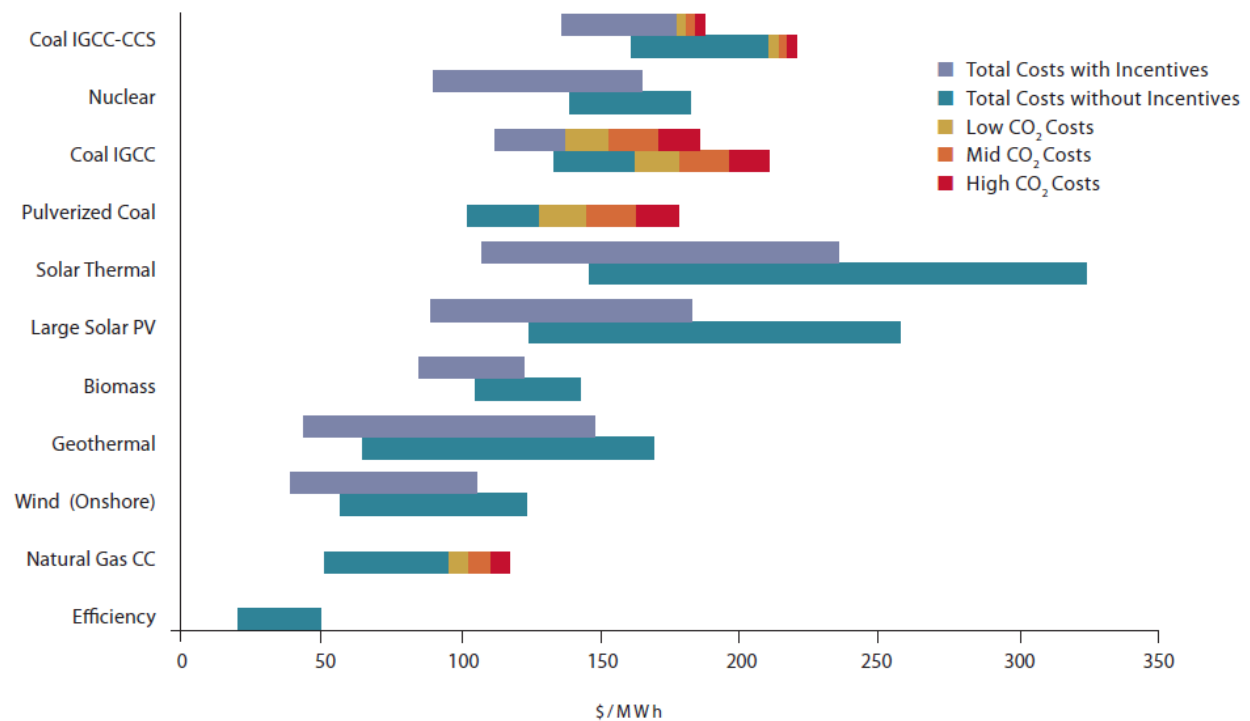
Renewable Energy Question #4: What are the predicted costs of new energy generation by type in the future? How would a carbon tax, increased carbon regulation, and the elimination of specialized tax treatment impact those cost estimates?

NOTE: This response addresses Renewable Energy Questions #4, 10 and 11 which have to do with the costs of various energy resources.

The figure below shows a range of levelized costs of generating electricity from different technologies, assumed to come on-line in 2015, with and without incentives and costs for carbon dioxide (CO₂) emissions. The data comes from a 2011 study by the Union of Concerned Scientists (UCS) called, *A Risky Proposition: The Financial Hazards of New Investments in Coal Plants*. It is worth noting that Energy Information Administration's (EIA) most recent levelized cost estimates for different technologies in 2018 fall within this range (EIA 2013). As defined by EIA, "levelized cost represents the present value of the total cost of building and operating a generating plant over an assumed financial life and duty cycle, converted to equal annual payments and expressed in terms of real dollars to remove the impact of inflation."

The range of costs reflects uncertainty in capital and fuel costs, as well as regional variations in costs and resource quality. The assumptions are based on project specific data, where available, and recent estimates from power plant construction and engineering firms, financial institutions, utilities, and state and federal agencies. More details on the cost and performance assumptions for each of these technologies can be found in [Appendix A of the study](#).

Figure 1. Levelized Cost of Electricity for Various Technologies



Source: Freese et al 2011.

Without incentives and CO₂ costs (lower bars), you can see that new natural gas combined cycle (NGCC) plants, onshore wind, and the best biomass and geothermal projects are cheaper than or competitive with a new pulverized coal plant, and energy efficiency is by far the cheapest option. When you include incentives and CO₂ costs, the best large scale solar PV and concentrating solar thermal projects also become competitive. You can also see that coal with carbon capture and storage (CCS) is not competitive with other alternatives, even with incentives. And new nuclear plants are only competitive with a new coal plant when you include generous loan guarantees and other incentives or high CO₂ costs, and are more expensive than new NGCC plants, efficiency and many renewable energy technologies.

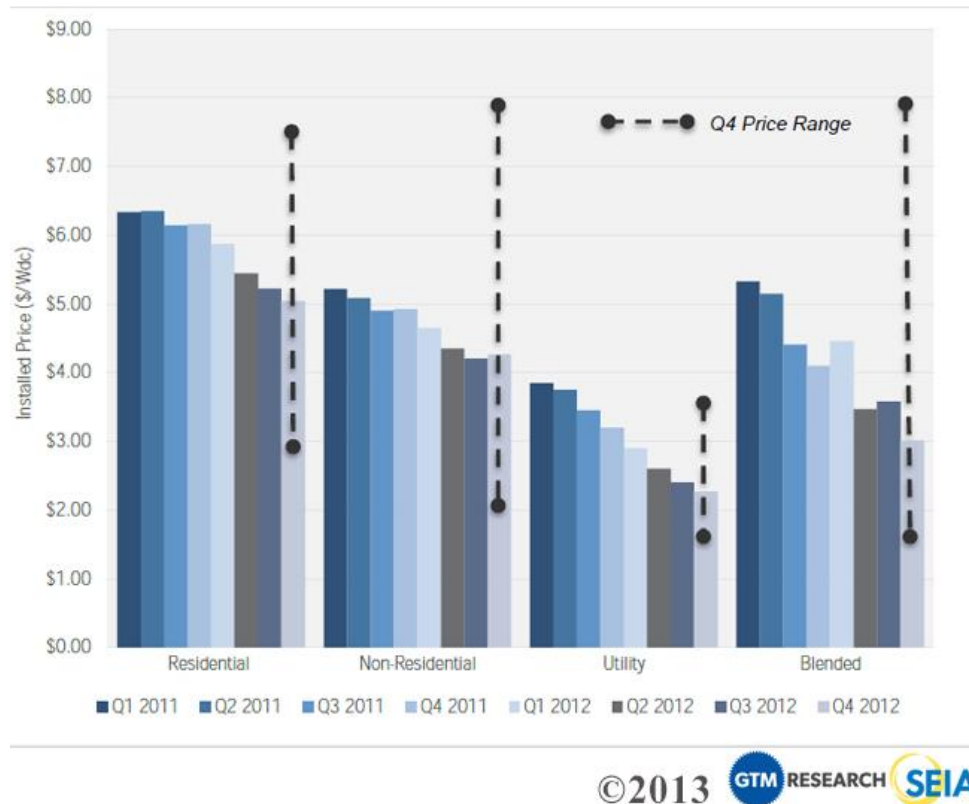
The range of future CO₂ prices assumes \$13/ton in the low case, \$26/ton in the mid case, and \$43/ton in the high case. These estimates are based on a 2011 study reviewing more than 75 different scenarios examined in the recent modeling of various federal climate bills, as well as estimates used by a number of electric utilities in their resource plans (Johnston 2011). These prices should be considered conservative, as the [report has since been updated](#) with higher levelized CO₂ prices ranging from \$23/ton to \$59/ton.

The other significant changes that have occurred since the UCS study was released in 2011 are a decline in natural gas prices and the cost of wind and solar PV projects. The range of natural gas (and coal) prices used in Figure 1 are based on EIA projections from Annual Energy Outlook 2011 (AEO 2011). The recent decline in natural gas prices over the past two years is already captured in the lower end of the range in the figure. This is evident in EIA's most recent levelized cost estimate of \$65.6/MWh for a new advanced NGCC plant with a 2018 in-service date (EIA 2013). The ~\$20/MWh (33%) decline in average wind costs in the past three years, as shown in the response to question 3, would reduce the low end of the range of levelized wind costs in Figure 1 by approximately \$10/MWh.

The cost of solar PV has also fallen dramatically over the past few years. A recent report from the Solar Energy Industries Association (SEIA) that uses a large sample of data from actual projects shows that the average installed cost of a completed PV system dropped by 27 percent over the past year, as shown in Figure 2. The study also found that the average price of a solar panel has declined by 60 percent since the beginning of 2011. These cost reductions are evident in several recent utility scale solar PV projects proposed or approved in the Southwestern U.S. that have PPA prices in the \$58-\$100/MWh range, including federal tax credits (Marks 2012, Bloomberg 2013). This would reduce the low end of the range for large scale PV in Figure 1 by ~\$30/MWh. Significant cost reductions have also occurred for residential and commercial scale PV systems as shown in Figure 2.

While Michigan's solar resources are not as good as the Southwest, recent and projected cost reductions combined with the availability of the 30 percent federal investment tax credits through 2016 will make solar PV systems increasingly competitive with conventional and other renewable energy technologies in the state. With recent wind projects installed in Michigan in the \$52-65/MWh range, wind power is already considerably cheaper than new coal plants and competitive with new natural gas power plants. And wind costs are likely to fall even further over the next few years, according to experts from Lawrence Berkeley National Laboratory (Wiser et al 2012).

Figure 2. Average Installed Price of Solar PV by Market Segment, 2011-2012



Source: SEIA 2013.

While these “levelized” costs cost comparisons are a useful screening tool for new power plants, they don’t reflect the full value and costs that different technologies provide to the electricity system. For example, it doesn’t include transmission and integration costs, reliability needs, the ramping flexibility that natural gas and hydro plants can provide, siting and permitting challenges, and the ability of new technologies to replace existing power plants. Figure 1 also doesn’t consider changes in the future costs for different technologies. The cost of some technologies--such as wind, solar and carbon capture and storage (CCS)--are likely to decline over time with increased development, economies of scale in manufacturing, experience, and technological innovation. The cost of other technologies, such as natural gas and coal, are likely to increase as supplies become more limited and fuel prices rise over time.

Modeling recently completed by UCS [and others] that have taken these factors into account have found that it is feasible and affordable for Michigan and the U.S. to significantly increase electricity from renewable energy to much higher levels over time. For example, UCS’ 2011 study *A Bright Future for the Heartland* used a modified version of EIA’s National Energy Modeling System to analyze the costs and benefits of increasing renewable energy and energy efficiency in the Midwest (Martinez et al 2011). The study found that increasing renewable energy to 30 percent of the electricity mix by 2030 in Michigan and other Midwest states would lower electricity and natural gas bills in Michigan by \$9 billion, when combined with investments in energy efficiency. The study also found that investing in renewable

energy and efficiency would create 15,300 more jobs than using coal and natural gas to provide the same amount of electricity.

Resources:

1) Energy Information Administration (EIA). 2013. *Levelized Cost of New Generation Resources in the Annual Energy Outlook 2013*. Online at:

http://www.eia.gov/forecasts/aeo/er/electricity_generation.cfm

2) Freese, B, Clemmer S., Martinez C., and Noguee A. 2011. *A Risky Proposition: The Financial Hazards of New Investments in Coal Plants*. Cambridge, MA: Union of Concerned Scientists.

http://www.ucsusa.org/assets/documents/clean_energy/a-risky-proposition_report.pdf

3) Johnston, L., E. Hausman, B. Biewald, R. Wilson, and D. White. 2011. *2011 carbon dioxide price forecast*. Cambridge, MA: Synapse Energy Economics. Online at

<http://www.synapseenergy.com/Downloads/SynapsePaper.2011-02.0.2011-Carbon-Paper.A0029.pdf>.

4) Marks, J. A. 2012. Concurrence. Case No. 11-00218-UT. *IN THE MATTER OF THE COMMISSION ESTABLISHING A STANDARD METHOD FOR CALCULATING THE COST OF PROCURING RENEWABLE ENERGY, APPLYING THAT METHOD TO THE REASONABLE COST THRESHOLD, AND CALCULATING THE RATE IMPACT DUE TO RENEWABLE ENERGY PROCUREMENTS*. Santa Fe, NM: New Mexico Public Regulation Commission. (PDF included in Appendix).

5) Solar Energy Industries Association (SEIA) and GTM Research. 2013. U.S. Solar Market Insight Q4 2012 Report. Online at: <http://www.seia.org/research-resources/us-solar-market-insight>

6) Martinez, C., J. Deyette, S. Sattler, A. McKibben. 2011. *A Bright Future for the Heartland: Powering Michigan's Economy with Clean Energy*. Cambridge MA: Union of Concerned Scientists.

http://www.ucsusa.org/assets/documents/clean_energy/A-Bright-Future_Michigan.pdf

7) Goossens E. and C. Martin. 2013. "First Solar May Sell Cheapest Solar Power, Less Than Coal."

Bloomberg. <http://www.bloomberg.com/news/2013-02-01/first-solar-may-sell-cheapest-solar-power-less-than-coal.html>

8) Wiser, R., E. Lantz, M. Bolinger, M. Hand. 2012. *Recent Developments in the Levelized Cost of Energy from U.S. Wind Power Projects*. Online at: <http://eetd.lbl.gov/ea/ems/reports/wind-energy-costs-2-2012.pdf>.

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF THE COMMISSION)
ESTABLISHING A STANDARD METHOD)
FOR CALCULATING THE COST OF)
PROCURING RENEWABLE ENERGY,)
APPLYING THAT METHOD TO THE)
REASONABLE COST THRESHOLD, AND)
CALCULATING THE RATE IMPACT DUE)
TO RENEWABLE ENERGY)
PROCUREMENTS)

Case No. 11-00218-UT

CONCURRENCE

New Mexico's commitment to including renewable energy in the resource portfolios of electric utilities dates back to the Commission's original specification of Renewable Portfolio Standards in 2002 via an administrative rulemaking. The evolution of this policy has been guided by the statutory adoption of the RPS in 2004, subsequent statutory amendments, intermittent rulemakings on various aspects of the RPS, and the ongoing cycle of annual renewable procurement plan cases.

The RPS has been successful. Today, all three of our investor-owned utilities have reached the second major milestone of having 10% of all retail electric sales arising from renewable energy sources (or in the case of PNM, having an approved plan that will result in full compliance soon). Additional renewable energy is supplied to customers through voluntary renewable energy tariffs, where PNM's voluntary program has been recognized nationally for its participation rates and will soon include a solar component. Four large-scale wind farms serve New Mexico utility customers through long-term purchased power agreements, with three more supplying other markets. Thanks largely to the diversity targets established by the Commission

by rule in Case No. 07-00157-UT, New Mexico's utility-scale solar electric generation quotient went from nil to 153 MW, with another 20 MW approved for deployment next year. A separate category, distributed solar generation, climbed from less than 100 kw to more than 20 MW. In 2011, New Mexico was ranked number one nationally in solar electric watts per capita.

Despite the fears of skeptics, we have accomplished our goals without causing unmanageable problems for grid operators and without subjecting utility customers to unreasonable and excessive costs. Technological and manufacturing progress has continued to drive down costs for new wind and solar energy resources, driven by commercial demand created by RPS policies of U.S. states and similar initiatives around the globe. The decline in cost for solar energy to the customer has been especially dramatic – the Commission just approved a solar procurement at a levelized cost of \$77 per MWh. Our current year reasonable cost threshold (RCT) is 2.25%, and while the application of the RCT has heretofore been subject to differing interpretations, it is clear that net bill impacts considering avoided costs, are modest. But for (welcome) decreases in natural gas prices, added costs for RPS compliance would be even less of an issue; in fact, during past periods when natural gas prices were high, ratepayers experienced savings due to low-cost wind energy contracts made for RPS compliance purposes.

Policies that encourage renewable energy substitution for conventional resources have overwhelming support among the general public. A 2012 Colorado College survey of New Mexico voters found that “71% would tell their State Legislator to maintain the current standard knowing it was put in place to help create clean energy jobs, promote energy independence and provide locally created energy, while 24% would opt to reduce the standard in order to help

bring down electricity rates.”¹ In that survey, two-thirds of New Mexicans picked solar as one of their top two preferred energy sources, followed by wind energy. In a recent national poll, 92% of all voters said that it was important for America to develop and use more solar power.² In the present case, my office received emailed comments from around two hundred members of the general public, both individually and as part of petitions and campaigns, *all but one* in favor of keeping or increasing diversity targets and taking a pro-renewable energy to the RCT.

Numerous entities representing environmental and renewable energy industry interests actively participated in the proceedings with well-taken comment, testimony, and briefs.³ PRC Staff brought an objective perspective to the case, supporting the effectiveness of diversity targets and the rationale for encouraging solar energy in New Mexico, and providing a usable framework for RCT calculations. Even New Mexico investor-owned utilities, as evinced by comment and testimony in this case, have for the most part accepted and adapted to the Commission’s renewable energy policies, including the diversity targets. Among stakeholders, opposition to policy-driven renewable energy development was largely limited to the Attorney General and NMIEC, who nevertheless represent important constituencies.

Given these factors, along with the continued relevance of legislative findings that the generation of electricity through the use of renewable energy presents opportunities to promote energy

¹ Colorado College, State of the Rockies Report 2012, retrieved from <http://www.coloradocollege.edu/other/stateoftherockies/conservationinthewest/>

² SEIA National Solar Survey 2012 (September 2012), retrieved from <http://www.seia.org/research-resources/america-votes-solar-national-solar-survey-2012>

³ Commendations are in order for NM REIA for particularly strong written pleadings, CCAE/WRA for continued dedication to developing creative solutions, Vote Solar Initiative for a long-term commitment to share national expertise and experience with our state, and the New Mexico Green Chamber of Commerce for effective advocacy.

self-sufficiency; preserve the state's natural resources and pursue an improved environment in New Mexico; that utilities should be required to have minimum amounts of diverse sources of renewable energy in their portfolios, and should be encouraged to exceed those minimums (NMSA § 62-16-2); it is disheartening that a dominant theme in the current proceeding was skepticism towards policies that seek to go beyond paper compliance with the REA and actually reach for its aspirational goals.

The Commission's Final Order dodges the worst of the attacks, and holds the center. The Final Order accomplishes the important objective of ratifying the successful, *a priori* target-based approach to achieving statutorily-mandated diversity, and explaining why opposing arguments are not well-taken. It establishes a standardized approach to the calculation RCTs that results in a test that truly reflects incremental bill impacts, including all material avoided costs. It extends an invitation to neighboring states to join New Mexico in a non-discriminatory interstate market for renewable energy (a market that New Mexico, with its abundant high-quality resources, would be poised to benefit from). It promulgates language to implement 2011 REA amendments enabling self-directed public entity renewable energy programs. I commend Commissioners Becenti-Aguilar, Howe and Hall for joining me in supporting the Commission Final Order and a compromise resolution that benefits New Mexico. The Final Order is arguably the best possible order that could garner majority support in the foreseeable future; the alternative would have chilled the development of a diverse portfolio of renewable energy.

Based on the comment and evidence in the case record, I would have retained the 10% "other" diversity target. As the Final Order points out, biomass, biogas, geothermal, and hydro projects can provide important dispatchability benefits to resource portfolios. FO ¶ 38. Successful development of biogas holds the promise of leveraging existing high-efficiency generating plants with a "green" fuel, as well as offering a needed solution to waste disposal problems challenging commercial dairies in Southern New Mexico. A 10% diversity targets would have kept the pressure on utilities to develop successful projects in that area. And, since unreasonable expensive or uncertain projects are already rejected, cutting

the target to 5% provides no actual benefits in cost savings. All it does is make it less likely that our state will even try to succeed in this area.

I also would have changed the language in Section 13 (C) of the rule to read “A utility shall select resources based on net present value analysis, long and short term rate impacts, and operating characteristics such as availability, reliability, and dispatch flexibility.” The language adopted in the Final Order makes “cost-effectiveness” the only criterion for procurements not needed to meet diversity targets, contra to the statutory principles in the REA whereby resources’ technical characteristics, as well as cost, are to be considered in constructing portfolios. I am concerned that the adopted language could prevent pursuit of portfolios that otherwise make sense; e.g., a solar-heavy portfolio for El Paso Electric, which has excellent solar but no wind resources within its footprint. It was the Commission’s position during debate that no changes to the adopted language were needed in to permit utilities the flexibility to use something other than the least-cost resource (as defined in the rule) when a different resource was more advantageous, all factors considered, because utilities could obtain variances in such a situations. I hope this proves correct.

Finally, while the RCT percentage is a policy determination in which the Commission balances competing goals, there are facts such as public preferences, as determined through survey research, and cost estimates under various scenarios, that can inform the decision. It is critical that we not undercut public support for sustainable energy source by wasteful spending; however, information we have suggests that public opinion would likely support slightly higher RCTs, as recommended by Staff, if needed in future years. This could be looked at with more rigor in any future proceedings.

This Concurrence should be served on all parties to the service list. Filed this 26 day of December 2012 at Santa Fe, New Mexico.

/s/

Jason Marks
Commissioner

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

**IN THE MATTER OF THE COMMISSION)
ESTABLISHING A STANDARD METHOD FOR)
CALCULATING THE COST OF PROCURING)
RENEWABLE ENERGY, APPLYING THAT)
METHOD TO THE REASONABLE COST)
THRESHOLD, AND CALCULATING THE)
RATE IMPACT DUE TO RENEWABLE)
ENERGY PROCUREMENTS.)**

Case No. 11-00218-UT

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that a true and correct copy of the foregoing Jason A. Marks's Concurrence was sent by electronic mail on December 27, 2012, to the individuals listed below.

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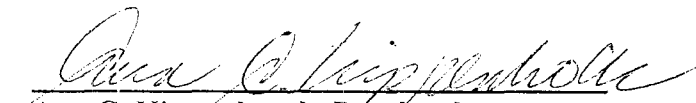
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NEW MEXICO PUBLIC REGULATION COMMISSION


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